Forest Health Technology
ENTERPRISE TEAM UPDATE

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Team contributes to China conference

Five Enterprise Team leaders and members joined Forest Health Protection Director Ann Bartuska and other FHP staff in September 1997 on a visit to the People's Republic of China. The visit's purposes: to review the accomplishments of a cooperative project in Anhui Province; to meet with Ministry of Forestry, Chinese Academy of Forestry, Provincial forestry and forest health protection specialists, and other Chinese officials to discuss areas of potential cooperation; and to attend and participate in the Resource Technology 1997: Beijing Forest Health Protection International Symposium. The Enterprise Team was a sponsor of the international symposium, attended by more than 90 participants from eight countries.

A panel of U.S. and Chinese forest health experts opens the Resource Technology 1997 conference in Beijing

Team members for the visit were, besides Bartuska, Allan T. Bullard, Director, Enterprise Team-Morgantown; Bov B. Eav, former Enterprise Team leader and Director, Enterprise Team-Fort Collins; Gary L. DeBarr, Southern Research Station, Athens, Georgia; and Kenneth H. Knauer, Northeastern Area, Radnor, PA. Additional Enterprise Team attendees and presenters at the conference were Jim Bunch and Lowell Lewis of Enterprise Team-Fort Collins and Yun Wu of Enterprise Team-Morgantown.

See **China**, page 3

Inside . . .

How to keep on truckin' while shifting gears	2
Conference accomplishments noted	4
Eav: Enterprise Team accomplishments and future challenges	5
Data visualization in action	6
Theatrical special effects produce dramatic results in pheromone study	7
Enterprise Team-Morgantown rings out the old, in the new	8
Team publications available	11
Quick Turnaround key to blowdown mission	11
Team hosts workshop, training	12
Recent publications	15
Events of Interest	back page

Eav to direct NE Station

Enterprise Team Leader and Director of Enterprise Team-Fort Collins Bov Eav was selected as Director of the Forest Service's Northeastern Forest Experiment Station on December 3, 1997. Allan T. Bullard, Director of the Enterprise Team-Morgantown, is acting Enterprise Team Director. Jesus Cota, of the Washington office of Forest Health Protection, is acting as director of the Enterprise Team-Fort Collins.

Bov B. Eav, Team Leader and Director of Enterprise Team-Fort Collins was named director of the Northeastern Forest Experiment

Forest Service Chief Mike Dombeck described Eav as a leader of outstanding skills and personal qualities who has furthered the agency's ability to protect forest health and work with a wide range of partners. "Bov Eav is

See **Eav**, page 5

Working as a Team

TeamWork: Working as a Team *is an ongoing column dealing with the nuts-and-bolts problems of getting work done in an enterprise team. We will share some of our successes and point out some of the pitfalls we encounter as the Enterprise Team moves with the Forest Service into the 21st century.*

How to keep on truckin' while shifting gears

We all know that change is an inevitable part of life. Nevertheless, we tend to agree, in our hearts, with the opinion of eighteenth-century lexicographer Dr. Samuel Johnson that change is, on the whole, a bad thing. People who work on teams are as aware as anyone of both the inevitability of change and the discomfort that accompanies it.

We know from experience that to change the membership of a team is to change that team's dynamics. Each addition or subtraction of team members is to some extent a back-to-the-drawing-board matter. It's not simply a case of teaching new members how things are done. It's more like starting to build the team all over again.

So how does a team undergoing personnel changes cope? What is necessary in order for the team's work to continue along with the rebuilding process? These questions, we suspect, will become painfully apt for the Enterprise Team as we enter 1998. Added to our usual complications of having to deal with a large number of wide-ranging and disparate technical projects carried on with different partners and collaborators over various distances, political boundaries, governmental agencies, and other institutions, we will have the additional complications of changing team membership—most notably the loss of Bov Eav, Team Leader and director of the Enterprise Team-Fort Collins. We will need to apply all of the team working skills we've been practicing for the past three years and then some.

But before we let our angst overcome us, let's count our team work blessings.

First, we are committed to the team concept and the team mechanism. We have built teams over the past three years and can continue to build them in the future.

Second, we have, thanks to our leaders to date, a strong sense of our vision and mission: To foster the development and use of technologies to protect and improve the health of America's forests.

Third, as a team we share important core values:

- The importance of solid, science-based information
- The value of translating scientific research into practical technology which can be used readily and efficiently in the field
- The importance to the nation of our overall goal of protecting and enhancing forest health

And finally, our leaders have demonstrated and taught us some top-notch team and communication skills:

- The attitude and skill of empathy, so that we can work better with our team mates and our partners and collaborators
- A sense of our own independence and interdependence, so that we know where our individual skills and contributions fit into the work of the team and where we need to depend on each other
- Leadership maturity, which trusts each of us to perform our tasks as competent professionals
- The pattern of seeking win-win relationships, so that we know that what's good for the team is good for each of us

See Truckin', page 3

ENTERPRISE TEAM UPDATE

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Truckin', from page 2

- The technique of using individual differences for the good of the team's mission, so that we know our individual knowledge and skills are valued
- The ability to grow our own leadership qualities

Peter Drucker is supposed to have said that sooner or later all plans degenerate into work. As that happens, the Enterprise Team will have the values and skills we need to keep our focus.

And perhaps we will find that, Dr. Johnson to the contrary notwithstanding, change is, after all, not such a bad thing.

Shirley Wilsey

China, from page 1

Aerial Sketchmapping and Airborne Video accomplishments reviewed

For the Anhui Province portion of the visit, Bartuska, Eav, and Knauer met with Mr. Zhou Jian Sheng, Director of the Anhui Province Forest Biological Control Center (APFBCC), and his staff to assess the accomplishments of the Training Support Plan for Aerial Sketchmapping and Airborne Video Applications in Forest Health Protection between APFBCC, the Ministry of Forestry, and USDA Forest Service Forest Pest Management. The team found that all the objectives of the Plan had been met and made recommendations for activities to enhance the effectiveness and efficiency of the application of the newly acquired technologies.

Bartuska, Bullard, Eav, and Knauer also met with Mr. Wu Jian, Ministry of Forestry and officials at the Chinese Academy of Forestry (CAF) to discuss structure and activities of the Research Institute of Forest Protection (RIFP), which was formed in 1994 to help protect the forest ecological environment and afforestation achievements of China.

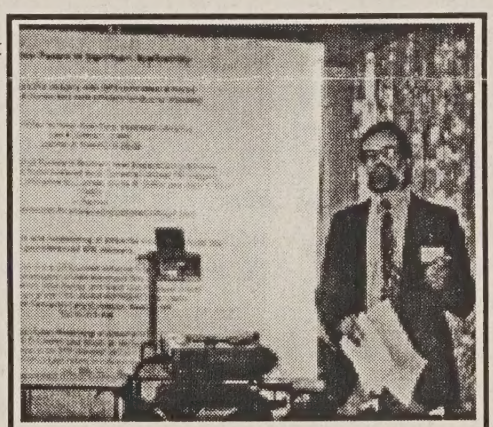
Successful Symposium ends five-year agreement

The centerpiece of the visit was the Symposium, the culmination of a five-year U.S.-China cooperative agreement on forest health technology. Sixty papers were presented. Concurrent sessions were held in nine subject areas: Biological Control and Biopesticides; Interactions between Hosts and Insects; Human Dimensions of Forest Health; Forest Health Information; Innovative Technologies for Forest Health; Remote Sensing/Airborne Video for Forest Health Management; Detection, Evaluation, and Monitoring; Spatial Analysis for Forest Health Management; and Biosystems Modeling and Decision Support Systems. Each subject was co-moderated by a U.S. specialist and a Chinese specialist in the subject area.

Madam Zhou of the CAF and Bartuska began the Symposium with overviews of forest health issues and priorities in China and the U.S. They were followed by a presentation on the history of U.S.-China cooperation in forest health technology by Knauer. Following the subject area sessions, Eav and Bullard presented summaries of recent accomplishments and future directions in information technology for forest management and biological control and biopesticides in the U.S. Dr. Chen Changzie, Honorary Director of the RIFP, summarized forest protection technology development and future needs in the PRC. The Symposium Proceedings are being published.

Future cooperation discussed

After the Symposium team members returned to the CAF for discussions on potential future cooperation at a meeting with Ministry of Forestry and CAF staff and representatives from Anhui, Jilin, Guangdong, Shaanxi, Sichuan, and Yunnan Provinces, as well as representatives from Beijing Forestry University and Peking University. Top priority areas for cooperation suggested by the Chinese were technology for detection and monitoring of forest pests and forest health; development of decision support systems; and continuing activities in biological control, principally of *Oracella acuta* and long-horned beetles. The top priority for the U.S. side was biological control, including locating and identifying natural enemies of pests such as hemlock woolly adelgid and mile-a-minute weed. Eav and Bullard of the Enterprise Team will serve as



Lowell Lewis of the Enterprise Team-Fort Collins delivers presentation at Resource Technology 1997 conference

See China, page 4

China, from page 3

U.S. contacts for future activities and will prepare a draft agreement outlining the mechanism for preparing and implementing future projects. A Chinese contact will be named later.

Visits to field sites—inspecting windbreak poplars infested by *Anoplophora nobilis* in Shaanxi Province and touring the Woolong Nature Preserve northwest of Chengdu in Sichuan Province—and meetings with Dr. Li Rongwei, Deputy Director of the Forestry Academy of Sichuan, and other staff members, followed. Pests of special concern in the forests of Sichuan are *Dendrolimas* sp., affecting pines, *Lymantria dispar*, affecting hardwoods, *Parocneria orienta*, affecting *Cupressus* sp., and *Pseudomonas syringae*, which cankers kiwi fruit. Another concern is possible damage to approximately 80,000 hectares of slash and loblolly pine planted in the Province should *Oracella acuta* arrive to affect them.

Chinese work on natural controls for major pests include processing and producing gypsy moth nucleopolyhedrosis virus (NPV) and the NPV of *Dendrolimas*. The Province is also cooperating with Dr. Michael Montgomery of the Northeastern Forest Experiment Station, Hamden, CT, in locating and collecting natural enemies of hemlock woolly adelgid for identification and possible shipment to the U.S. for evaluation as a potential biological control agent for this introduced pest.

Ken Knauer and Ann Bartuska examine evidence of damage from Oracella acuta *infestation in Guangdong seed orchard*

U.S. Forest Health Protection staff visit sites in China. From left, Bov Eav, Enterprise Team; Ken Knauer, Northeastern Area; PRC host; Ann Bartuska, Director, Forest Health Protection

Foresters visit *Oracella* introduction site

Finally, the team flew to Guangzhou to meet again with Mr. Wu Jian, Minister of Forestry, and officials of the Station of Pest Control of Guangdong Province, Guangdong Province Office of Forestry Affairs and Finance, and Guangdong Entomological Institute. Here they visited the seed orchard where *Oracella acuta* was first introduced into China. Heavy infestations and damage are occurring, and the infestation is spreading.

The group observed procedures for releasing parasitoids shipped from the U.S. by Dr. DeBarr and visited the quarantine and mass-rearing facility where the parasitoids are processed. Discussions which followed stressed the need for Chinese research on rearing, releasing, and monitoring *Oracella*; on the effectiveness of the parasites in China; and on the long-term impact of *Oracella* on the slash pines in Guangdong Province. U.S. scientists congratulated the Forestry Department and Station of Pest

See **China**, page 5

Conference accomplishments noted

The Update interviewed Bov Eav, former Director of the Enterprise Team and a presenter at the conference, for a first-hand impression of the results of Resource Technology 1997.

What did the Beijing conference accomplish?

The conference's chief accomplishment was the exchange of information between scientists of the two countries. The Symposium achieved an especially good summary of recent accomplishments by both countries in the use of remote sensing and biological control for forest health. The conference and meetings afterward also established the groundwork for future cooperation between the U.S. and the People's Republic of China in these areas.

How did the Enterprise Team contribute to the conference's success?

The Enterprise Team served as a catalyst: first, as sponsor of the conference, and second, as the catalyst for cooperation between the U.S. and China in these technical areas.

Are there promising areas for future cooperation with the PRC?

The U.S. and the People's Republic of China have common interests in continuing work in bringing advanced information gathering and analysis technology to forest health applications and in continuing exchanges in biological control, especially biological control of exotic—that is, introduced—pests in both countries. For the U.S., we are interested in continuing cooperation in biological control of the long-horned beetle, the hemlock woolly adelgid, and mile-a-minute weed, which were all introduced into this country from Asia. On the Chinese side, interest is high in maintaining cooperation in biological control of *Oracella acuta*, a mealybug which damages pines.

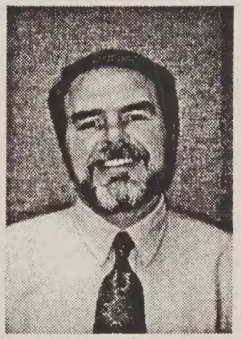
Eav, from page 1

an expert in the development and delivery of emerging technology to improve forest health. He is equally gifted at collaboration and building partnerships. We are fortunate to count Bov among our new leaders. His leadership of the Northeastern Station will further the impressive accomplishments of Forest Service research."

Eav joined the Forest Service in 1985, at what was then the Methods Application Group (MAG), located in Fort Collins, CO. He subsequently served as director of the National Center for Forest Health Management in Morgantown, WV, where he built a broad coalition of partners to address the need for effective, ecologically sound insect and disease treatments. When the National Center merged with MAG and the Pesticide Applications Group of Davis, CA in 1995 to form the Enterprise Team, he returned to Colorado to serve as team leader and director of the Enterprise Team-Fort Collins, where he focused on its task of transferring research results into effective technology for use by natural resource managers.

Before coming to the Forest Service, Eav was a principal scientist at Lockheed Engineering and Management Services, where he managed scientific payloads for NASA's space shuttle program and developed very high altitude imagery to detect forest pests and diseases. He came to the U.S. in 1972 from Phnom Penh, Cambodia, as a Fulbright Fellow. He holds a doctoral degree in biometrics and remote sensing from the State University of New York in Syracuse.

At the Northeastern Forest Experiment Station Eav will lead some 90 scientists who help to solve insect and disease problems, improve watersheds and wildlife habitat, develop the recreation potential of forests, and improve the economy of local communities through responsible use of the forest resource. The station conducts research in 14 of the most heavily forested states in the nation: Maine, Vermont, New Hampshire, Massachusetts, Connecticut, New York, Pennsylvania, Rhode Island, New Jersey, Delaware, Maryland, West Virginia, Ohio, and Kentucky. The forests in these states are predominantly on privately owned land.



Allan T. Bullard, Director of Enterprise Team-Morgantown, is acting Team Leader for the Forest Health Technology Enterprise Team

It is an honor to join the exceptionally talented employees of the Northeastern Station and to work on some of the most important issues in forestry," said Eav. "I look forward to using research results to help maintain and promote forest health in the Northeast, which may have national implications. To do this, I hope to foster an environment of collaboration, to strengthen existing partnerships, and to seek new ones with cooperating agencies, academic institutions, and many others who are concerned with natural resources."

Eav on Enterprise Team accomplishments and future challenges

The *Update* interviewed Bov Eav about his work at the Enterprise Team and his expectations for the future before he left to take up his new post at the Northeastern Forest Experiment Station in Radnor, PA. These were his comments.

What accomplishments are you most proud of as Team Leader of the Enterprise Team?

I am proud of getting the Team established and working as a team operation. We are now firmly established in using the team approach to doing work in a government setting—a challenge in itself.

We have established firm support for the Enterprise Team from leadership in State & Private Forestry and especially Forest Health Protection staff. I am proud of that. I am proud of our accomplishments in communication. We are going a good job of telling our story—who we are, what we've accomplished, and what we're working on.

I am very proud that we have achieved our enterprise goal of 60% core funding and 40% enterprise funding for the Enterprise Team, and that we have done it at least two years ahead of schedule.

What are you most looking forward to as Director of the Northeastern Forest Experiment Station?

I am really looking forward to new challenges and opportunities to participate as a leader in the Forest Service. I'm looking forward to applying what we've learned in the Enterprise Team to further integrate science and technology into resource management, but at a larger scale in the organization.

What do you most regret leaving at the Enterprise Team?

Leaving friends behind. It's been twelve-and-a-half years since I joined what was then the Methods Application Group. I will miss everyone—but the Forest Service is a small family. There will be opportunities to work together in the future.

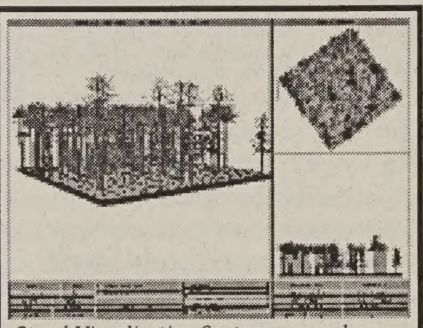
China, from page 4

Control of Guangdong Province for their fine work in establishing parasitoids of *Oracella* in China.

Shirley Wilsey

Data visualization in action

The latest data visualization tools are emerging as a powerful method for resource managers to foster the collaborative stewardship of America's forests. New data visualization tools have moved the presentation of data from two-dimensional rows and columns on spreadsheets to sophisticated computer simulations that convert



Stand Visualization System screen shows several views of a stand

spreadsheet data into three-dimensional images.

The Stand Visualization System (SVS), developed by Robert McGaughey of the Pacific Northwest Research Station, is one of these useful data visualization software packages. Tom Gregg of the Pacific Northwest Region's Forest Insect and Disease staff worked with McGaughey to incorporate tree images showing insects and disease impacts. Using detailed geometric models, SVS generates graphical images depicting forest stand conditions from comprehensive lists of stand components. SVS images may represent current stand conditions or projections of future conditions with the use of output from the Forest Vegetation Simulator (FVS). The images produced by SVS, while abstract, provide an easily understood representation of stand conditions. This helps communicate insect and disease impacts and forest management alternatives to a variety of audiences.

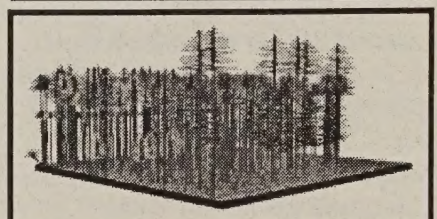
With SVS images generated from local forest stand data, resource managers can show a time-lapse presentation to demonstrate not only what the stand currently looks like, but also how models project it to look every decade for the next 50 or 100 years. Various forest management activities can be simulated to get an idea of how the forest stand will respond over time in terms of tree growth and death, seeding regeneration, insect and pathogen impacts, and the like.

The Enterprise Team recently had an opportunity to use an SVS presentation in just this manner. The area around Vail, Colorado, is facing a severe infestation of mountain pine beetles. Working with the forest health staff at the Gunnison Service Center, system analyst Matthew Oberle and program manager Dr. Eric Smith assembled and presented an SVS presentation as part of a Forest Service public meeting in Vail about the outbreak.

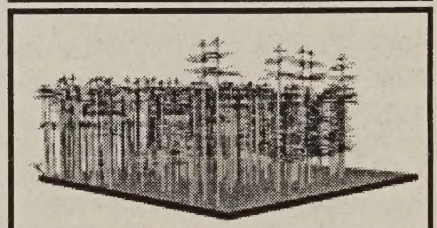
"Having the information converted into an SVS format was extremely helpful for showing how the current mountain pine beetle infestation might impact forest stands in the coming years," said Oberle. "It was also a great tool for illustrating how stands might look after the implementation of different types of silvicultural prescriptions, such as thinning intensities . . . prescriptions that could reduce the severity of mountain pine beele epidemics in the future."

"At last we have a tool to turn rows and rows of stand data on a computer printout into something everyone, including foresters, can quickly and easily relate to," Smith added.

SVS simulation of stand before bark beetle attack



SVS simulation of stand at height of bark beetle infestation



SVS simulation of stand a few years after end of bark beetle infestation

The Enterprise Team has been working with the Rocky Mountain Region's Lakewood Service Center to incorporate SVS imagery in an upcoming Environmental Impact Statement (EIS) on the Medicine Bow National Forest. The images will show the appearance of sample stands under alternative management treatments. Service Center Leader Dr. David Johnson likes the new tool. "Although we haven't had any direct response on the EIS images, in the past SVS presentations have received very positive feedback. We have found that, in general, SVS imagery for

See **Data viz**, page 11

Theatrical special effects join dramatic view in pheromone study

Understanding and manipulating pheromone communication to influence insect behavior is a useful pest management strategy for forest managers. Insects produce pheromones as chemical signals for mating, aggregation (finding host trees), anti-aggregation (discouraging other insects from approaching a tree) and other insect communication functions. Forest Service pest managers have expressed interest in developing methods to help in the efficient placement and spacing of pheromones used in various management strategies.

The Wind River Canopy Crane suspends bucket over the forest canopy to monitor dispersion patterns

Close up of Wind River Canopy Crane bucket

Some of the pheromones used by Forest Service pest managers are dispersed using "passive dispersers". This means that the pheromone source is simply set out in the stand and allowed to evaporate. The problems of interest here are the effective radius of an individual pheromone source, its optimum vertical placement, and how the effective radius and optimum vertical placement are influenced by meteorology and stand and foliage density.

Enterprise Team plays supporting role

A recently completed project funded by the Forest Health Protection-Special Technology Development Project by Warren Webb of Oregon State University developed a technique to visualize movement of a pheromone in a forest canopy. The project simulated the gaseous pheromone by generating smoke puffs using a theatrical smoke machine.

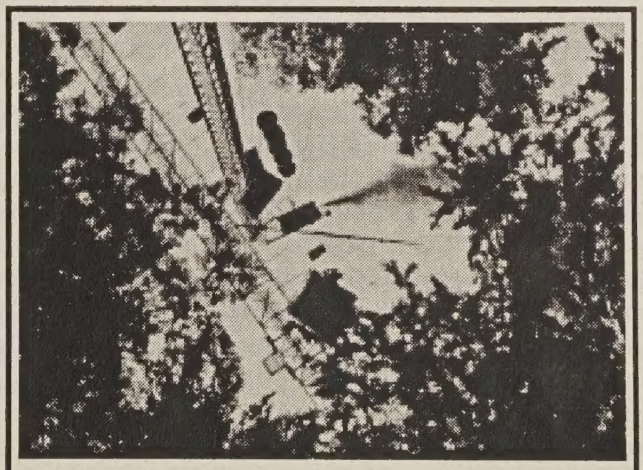
The Enterprise Team's role in the project was monitoring the micro-meteorology associated with the puffs.

The Oregon State University work was conducted on a site in Carson, Washington, known as the Wind River Canopy Crane. Developed by Forest Service Research and now administered by the University of Washington, this site has a 25-story construction crane located in the middle of an old growth Douglas fir stand. The crane is operated by a professional crane operator who joined the project out of the construction industry. The crane allows researchers to move in the canopy of the trees on site without damaging the fragile canopy ecosystem. The crane bucket is raised and lowered to the desired level anywhere in a circle with a radius of 270 feet. Enterprise Team/Missoula Technology Development Center personnel used the crane to erect a 33-meter tower mounted with wind sensors in a vertical array on the site. The tower helped researchers to understand how much of the pheromone might exit this type of stand vertically ('out the top').

Cameras record dispersion scenario

Webb logged the three-dimensional position of dozens of smoke puffs with an array of cameras. The associated meteorological data collection produced a wealth of data which is still to be analyzed. Two reports, one on the visualization method and one on the puff dispersion, are in review. Webb presented initial indications of appropriate pheromone spacing

See **Theatrical**, page 15



Wind River Canopy Crane with theatrical smoke machine emitting smoke puffs—seen from ground level

Enterprise Team-Morgantown rings out the old, in the new

The Forest Health Technology Enterprise Team in Morgantown sponsored 28 projects in Fiscal Year 1997. Of the total, four were completed. The rest will continue into FY 1998.

Ringing out the old

Enterprise Team-Morgantown projects which ended with Fiscal Year 1997 included two projects which reached completion, another with partial results, and one which requires cooperation from nature in order to proceed. The two completed projects are a two-year project to develop an operational program for managing the common pine shoot beetle in Christmas tree plantations and the publishing of proceedings of two conferences on the biological control of weeds.

The pine shoot beetle project was initiated by the National Center for Forest Health Management at the urgent request of pest managers, who needed immediate solutions in order to develop sufficient technology for transition to operational programs. The project evaluated a series of individual management options that could be integrated into a system for minimizing the risks of damage to Christmas tree plantations and interstate movement of the beetle. The recommended system of management options, which minimizes the use of insecticides, was evaluated in Michigan and in Indiana. By means of a compliance agreement, the project provided an alternative management strategy for growers to satisfy quarantine regulations.

An informal conference "Biological Control in Natural Areas" was held in December 1997 as part of the National Meeting of the Entomological Society of America in Nashville, TN. The Enterprise Team cosponsored the conference along with the U.S. Department of the Interior National Park Service and the U.S. Department of the Interior Geologic Survey. The Enterprise Team will publish a proceedings for this conference as well as one for another meeting, "Interagency Noxious Weed Symposium" sponsored by the Oregon Department of Agriculture and held in Corvallis, OR in December 1997.

The completed project with partial results was initiated by the National Center for Forest Health Management in response to a request from pest managers; it attempted to establish in Kenya natural enemies from North America to combat cypress aphid, an introduced pest affecting forests in Kenya. The project collected aphids in North America and Mexico and recovered parasites that were considered potential natural enemies of cypress aphid. These natural enemies were shipped to a quarantine facility in England for rearing and evaluation. None were subsequently released in Kenya, although a component of the project was successful, as a natural enemy collected in Scotland did become established on cypress aphid in Kenya.

A multi-agency effort to demonstrate silvicultural prescriptions for gypsy moth in the Appalachian mountains, was frustrated by failure of the insects to cooperate. Established in 1991 on the Jefferson National Forest in Virginia, this long-term Appalachian Integrated Pest Management project attempted to determine whether selected silvicultural options implemented at least three to five years prior to gypsy moth defoliation could reduce mortality of preferred species. Thirty-five stands were monitored in anticipation of the buildup of gypsy moth populations. However, because of factors unrelated to the project, gypsy moth did not move into the area in sufficient numbers for substantial defoliation to occur. The stands continue to be monitored by the Northeastern Forest Experiment Station in readiness for a future buildup of gypsy moth populations.

Ringing in the new

New projects to be undertaken in 1998 by Enterprise Team-Morgantown and its cooperators range from those which seek to collect and present information on management methodologies in easily accessible form, to studies of the effects of specific biological insecticides on specific insects, to the development of integrated pest management programs for specific pest insects and noxious weeds, to the determination of the impacts of pest management practices on nontarget organisms. These projects are concerned with a broad array of

See **Morgantown**, page 9

From **Morgantown**, page 8

pest species. The following paragraphs summarize the problems these projects seek to solve and the objectives they seek to reach. All of these projects are being accomplished together with the initial cooperators. For further information, contact the cooperators.

Sampling methodologies for integrated pest management of shade tree and forest insect pests

The Enterprise Team-Morgantown will be developing a comprehensive handbook for pest managers describing operational sampling protocols of tree pests. For each pest the handbook will provide information on the type of sampling procedure, the objective of the procedure, and a concise description of how to properly use the procedure. The handbook will also provide an annotated bibliography of relevant publications on sampling and action thresholds of forest and shade tree pests. It will provide a comprehensive listing in both text and table format to allow pest managers to look up individual pests and retrieve the latest information available on how to sample for the pest. The project also includes creating a searchable World Wide Web site that will provide sampling information for operational sampling protocols. For more information, contact Enterprise Team cooperator Scott Salom, Virginia Polytechnic Institute & State University, Blacksburg, VA, at 540-231-2794.

Biological insecticides for control of pine tip moths: Tip moth phenology and effects on natural enemies

The biological insecticides Mimic™ (an insect growth regulator) and Foray™ (a *Bacillus thuringiensis* product) have shown considerable promise for control of the Nantucket pine tip moth, *Rhyaciona frustrana* (Comstock). Screening trials have shown that both of these agents provide control competitive with that of conventional pesticides currently in use for operational control of tip moths.

Loblolly pine plantations in the coastal plain of Virginia and North Carolina have suffered heavy damage from tip moth attacks, and control attempts have not been very effective, apparently due to the difficulty of timing of applications. If the potential of these biologicals is to be realized, then appropriate timing techniques must be developed. Determining tip moth phenology will enable applications to be made at the proper time, when early instar larvae are either on the surface of the needle or shoot or feeding near the surface. An existing spray timing model is available; it could be modified to optimize tip moth control once the necessary data have been collected.

Substantial natural tip moth control already exists in the region in the form of parasites and predators. It is important that any insecticidal control program be designed to avoid disruption of these natural controls.

The project will evaluate the efficacy of biological insecticides and the effects of biological insecticides on the existing tip moth natural enemy fauna in the Virginia coastal plain. It will also describe the phenology of the Nantucket pine tip moth in the Virginia coastal plain, where control timing has been difficult in the past, and modify the currently available spray timing model to provide optimum control in the coastal plain of Virginia and North Carolina.

For additional information on this project contact Wayne Berisford at the University of Georgia, Athens, Georgia, at 706-542-7888.

Developing mass-trapping technology for the spruce beetle

Tree mortality caused by the spruce beetle periodically disrupts resource management plans in spruce forests throughout western North America. Mass-trapping with pheromone baited traps could provide a valuable alternative treatment for managing spruce beetle outbreaks.

This project aims to determine the optimal composition of trap lures for the spruce beetle by testing combinations of frontalin™, seudenol™ MCOL™, ethanol, and alpha-pinene™; to determine the optimal release rates of aggregation pheromones for trapping the spruce beetle; and to compare the efficacy of a new prototype bark beetle pheromone trap to that of the existing standard multiple-funnel trap.

For additional information on this project contact Darrell Ross, Enterprise Team cooperator at Oregon State University, Corvallis, OR, at 503-737-6566.

Development of an Integrated Pest Management program for the pink hibiscus mealybug

The pink hibiscus mealybug has recently been recovered in the Caribbean Islands. On islands such as Grenada this pest has exploded in epidemic proportions, affecting agricultural and ornamental plants as well as the island's forests, and causing significant damage. USDA Animal and Plant Health Inspection Service (APHIS) suggests that pests

See **Morgantown**, page 10

Morgantown, from page 9 similar to this one spread into the United States along the South American-Caribbean-Florida route. It is anticipated to reach Puerto Rico by 1997, and subsequently the U.S. mainland.

This project will rear natural enemies of the pink hibiscus mealybug in the laboratory, ship them to infested areas for establishment, evaluate their effectiveness in the field, and integrate natural enemies with other control tactics into an integrated pest management program for the pink hibiscus mealybug.

For additional information about this project contact Robin Morgan, International Institute of Tropical Forestry, Rio Piedras, Puerto Rico at 809-766-5335

Development of a biological program for Japanese knotweed

Japanese knotweed is a herbaceous perennial that reproduces by seed and by rhizomes. Native to eastern Asia, it is found in the eastern U.S. and in the coastal areas of Washington and Oregon. It spreads primarily along river banks but also grows in wetlands and in other disturbed areas. The Japanese knotweed's early emergence and great height combine to shade out other vegetation and to prohibit regeneration of other species. Thus, it reduces species diversity and damages wildlife habitat. It is considered a major weed and threat to conservation.

This project will evaluate the role of natural enemies in regulating Japanese knotweed in its country of origin as well as survey for and quantify the impact of native natural enemies and determine the distribution of the weed in the eastern U.S.

For additional information on this project contact Kathy Kidd at the North Carolina Department of Agriculture, Raleigh, NC at 919-233-8214.

Evaluation of forest management regimes for fire and thinning on the primary prey base of the California spotted owl

Forest managers in the Sierra Nevada need to answer the fundamental question of whether selective timber harvesting mimics the ecological effects of naturally occurring fire. Related questions are, "What ecosystem functions and processes does selective timber harvesting alter? What are the consequences of these changes, and how might their effects be mitigated?" An important but largely unexamined linkage in forest ecosystems is that between the mycorrhizal fungi, which are essential to tree nutrient uptake, the below-ground fruiting bodies produced by mycorrhizae (called "truffles"), and the small mammals which are highly dependent on truffles for food. Although truffles make up more than 70% of the northern flying squirrel's diet, and the squirrel is the principal prey base of the California spotted owl, little is known about the effect of forest management practices on this owl food source.

This project will first determine the effects of prescribed burning, understory thinning, and shelterwood cutting on truffle abundance and diversity. Secondly, the project will determine the relationship between truffle abundance and population levels of flying squirrels.

For additional information about this project contact Malcolm North, USDA Forest Service, at 209-487-5196.

Improve the biological basis for Gypchek use on Monongahela National Forest

The Monongahela National Forest's gypsy moth Integrated Pest Management policy favors using the most gypsy-moth-specific microbial insecticide in order to reduce undesirable or unknown impacts on nontarget native Lepidoptera in the Forest's ecosystems. *Brachionycha borealis* (Smith), one of twenty two macrolepidopterous moths listed as Species of Special Concern by the West Virginia Department of Natural Resources, occurs on the Forest and has influenced the choice of insecticide for gypsy moth suppression. Gypchek has been used extensively in place of commercial *Bacillus thuringiensis* (*Bt*) formulations such as Foray 48B.

From 1993 through 1995, Gypchek use in the oak forests inhabited by *Brachionycha borealis* increased from 19 to 100 percent. Higher Gypchek production and application costs each year and constraints on available suppression funds require that better biological data be available to support continued Gypchek use.

This project will determine the natural history of *Brachionycha borealis* in West Virginia and whether the larva of the moth is at risk through exposure to *Bt* rather than Gypchek.

For additional information on this project contact John Rawlins, Carnegie Museum of Natural History, at 412-622-3259.

These new projects, together with 24 continuing projects from Fiscal Year 1997, promise to give Enterprise Team-Morgantown a productive and busy year in 1998.

Richard C. Reardon and John D. Stein

Publications available

The publications in the following list are now available from Enterprise Team-Morgantown. The title of the publication is followed by the date at which it became available and the Enterprise Team publication number. To order, please contact Lisa Cress, Enterprise Team, USDA Forest Service, 180 Canfield St., Morgantown, CO 26505; Phone: 304-285-1563; Fax: 304-285-1505; DG mailbox: L.Cress:S24L08A; Internet: lcress@mserv.fsl.wvnet.edu

Enterprise Team-Morgantown

Bioinsecticides for forest and shade tree defoliators: Annotated bibliography of nontarget impacts. July 1997. FHTET 97-05.

Biological control of arthropod pests of the northeastern and north central forests in the United States: A review and recommendations. December 1996. FHTET 96-19.

Caterpillars of eastern forests. November 1997. FHTET 96-34.

Classical biological control of pest insects of trees in the southern United States: A review and recommendations. June 1997. FHTET 96-20.

Gypchek-The gypsy moth nucleopolyhedrosis virus product. October 1996. FHTET 96-16.

Hemlock woolly adelgid. December 1996. FHTET 96-35.

Proceedings of the first hemlock woolly adelgid review. June 1996. FHTET 96-10.

Semiochemicals of forest and shade tree insects in North America and management applications. September 1997. FHTET 96-15.

Other-Morgantown

Appalachian integrated pest management gypsy moth project: Summary and bibliography. December 1996. NA-TP-05-96.

National Center of Forest Health Management: Bibliography. June 1997. NA-TP-06-96.

Using mating disruption to manage gypsy moth: A review. December 1995. FHM-NC-08-95.

Quick turnaround key to blowdown mission

The Enterprise Team's Barry Russell delivered aerial photographs of the recent spruce blowdown in northern Colorado to Rocky Mountain Region forest managers within a very short time of the event. This quick turnaround was necessary for fast and accurate analysis of the extent of the damage so that forest managers could determine which areas were most susceptible to post-blowdown beetle infestations and which areas could be logged for salvage timber.

The blowdown, which attracted national media attention, occurred late in 1997 on the Routt National Forest northeast of Steamboat Springs, Colorado. About 20,000 acres of mature spruce was blown down by intense storm winds of at least 120 miles per hour. About 8,000 of the damaged acres are in non-wilderness areas; 12,000 acres are in the Mount Zirkel Wilderness. Forest managers are concerned about the danger of an epidemic of spruce beetle building up in the downed trees.

Bids were solicited from private contractors to perform the aerial photographs; however, none could perform the service with short turnaround time. The Enterprise Team was able to produce the photos within the necessary time window. Also, Russell's shots of the blowdown could be used immediately; there was no need to wait for spring to interpret the photographic data. Russell also photographed a similar, though smaller, blowdown on the Rio Grande National Forest in Colorado.

Shirley Wilsey

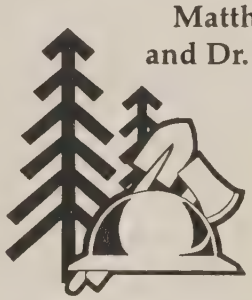
Data viz, from page 6

these kinds of landscape analyses have been worth a thousand words, and we anticipate that this will hold true for the Medicine Bow EIS." Dr. Johnson added, "District-level input regarding the use of SVS has been very positive." Past experience with SVS in the Rocky Mountain Region includes a presentation to the Audubon Society that received high marks.

Of course, other data visualization tools also do data-generated imagery. However, SVS can be run on nearly any desktop or notebook PC computer; its presentations tend to take less computing power and consume less computer memory. In fact, entire presentations, or significant portions of them, can be put on 3.5-inch diskettes and distributed to meeting attendees. Also, the Stand Visualization System software and its accompanying user's manual can be downloaded from the World Wide Web for free at:

http://forsys.cfr.washington.edu/svs.html

Matthew Oberle and Dr. Eric Smith



Team hosts workshop, training sessions

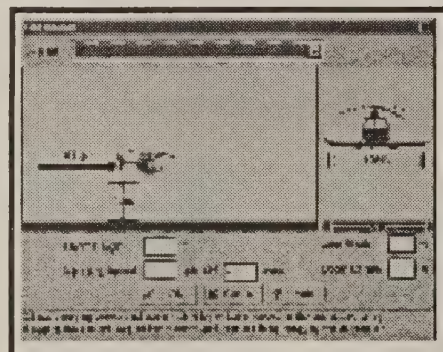
The Enterprise Team hosted two technology transfer events in the first quarter of fiscal year 1998. In October 1997 the Team's Insect and Pathogen Models Program, led by Judy Adams, held a training session in Fort Collins, Colorado, for Forest Health Protection Regional staff and resource managers.

Tom Gregg, Pacific Northwest Region, opened the session by discussing goals, expectations, and missed opportunities. Don Vandendriesche and Rich Teck, Forest Management Service Center, presented a brief overview of the Forest Vegetation Simulator (FVS) and introduced the group to the Stand Visualization System (SVS) developed by Bob McGaughy, a research forester with the Pacific Northwest Research Station. (See page 6 for more information on SVS.) Matt Thompson provided background information on the Suppose interface. Suppose is a graphical user interface (GUI) software for FVS developed by Nicholas L. Crookston of the Forest Sciences Lab in Moscow, Idaho. Background information, data requirements, and hands-on exercises for each of the pest models were covered by Ellen Goheen, Kathy Sheehan, and Helen Maffei, all from the Pacific Northwest Region. Joy Roberts, Intermountain Region, provided the perfect closing to this three-day session by discussing "Successional simulations using the FVS and multi-pest scenarios for various levels of planning."

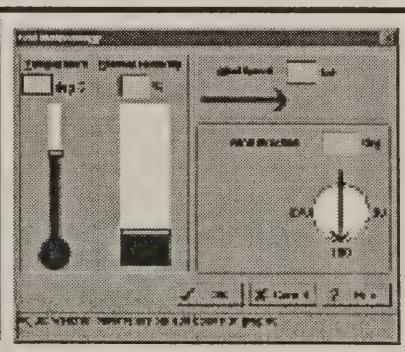
December 9-11, the Enterprise Team's Decision Support Systems Program, led by Stephen Williams, sponsored a Decision Support Systems Workshop consisting of demonstrations and discussions of eleven decision support systems now under development by various Forest Health Protection partnerships, including the Enterprise Team. A group of about 30 developers and users organized into small groups for demonstration sessions where they were able to compare notes, ask questions, and discuss applications of the software. The three-day workshop, facilitated by Cathleen Neelan of Steamboat Springs, CO, covered the following systems:

SpraySafe Manager, a decision support system for aerial application of herbicides in forestry, was demonstrated by Dr. Brian Richardson of the New Zealand Forest Research Institute, Rotorua, New Zealand. Developers Richardson, W. Schou, and J. Ray, with partners Milt Teske of Continuum Dynamics, Inc., and Jack Barry, formerly of the Enterprise Team, developed this aerial application decision support system by accessing subroutines of Forest Service Cramer Barry Grim (FSCBG), a validated aerial application simulation model, in a separate dynamically linked library. Together they create a complete program which assists forest managers in assessing risks from herbicides used to manage vegetation in New Zealand's plantation forests.

Gypsy moth Expert System (GypsES), a decision support system for managing forest pests, was demonstrated by Susan J. Thomas, of the USDA Forest Service Northeastern Forest Experiment Station. GypsES is a Geographic Information System (GIS)-based program developed by the Forest Service and several cooperating universities designed to provide current scientific knowledge of the gypsy moth to pest managers, particularly at state and county levels. The software combines various tools, including a database manager, a GIS, and a decision-support rule base. Recent developments in airplane guidance systems (Differential Global Positioning Systems, or DGPS) have improved the accuracy and effectiveness of aerial treatment. GypsES provides an interface with several widely used DGPS navigation systems. Current GypsES users include state and county gypsy moth coordinators in Virginia, North Carolina, Tennessee, Arkansas, Indiana, and Ohio. It is also used to assist in



SpraySafe Manager screen: Dialog for editing aircraft type and operating parameters



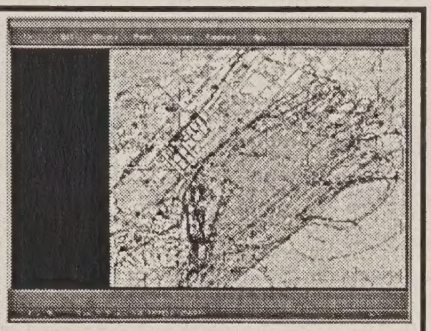
SpraySafe Manager screen: Dialog for editing meterological confditions

See **Workshop**, page 13

Workshop, from page12

administering the treatment process in Michigan and West Virginia, and has been purchased by the Animal and Plant Health Inspection Service (APHIS). It is being evaluated for possible use in four provinces by the Canadian Spray Efficacy Research Group (SERG).

Defoliation prediction based on egg-mass survey (Gansner Model) for Quantico Marine Base in Virginia. (Screen from GypsES project)



Erwin, TN 1995 Spray Project showing block and actual flight lines over quad backdrop

SPBIS, the Southern Pine Beetle Information System, was demonstrated by Doug Rubel of Forest Health Protection staff, Pineville, LA. This "simple database application" is being designed to provide simultaneous support for the entire range of needs in the USDA Forest Service for southern pine beetle managers. The system, developed from a non relational type database long in use by managers, uses graphic user interface (GUI) applications instead of the old character-based programs. SPBIS records and assists in the management and control of about 5,000 southern pine beetle spots per year. Although it is neither an expert system nor a decision support system, it manages the information collected and presents it in a form that allows managers to make informed decisions.

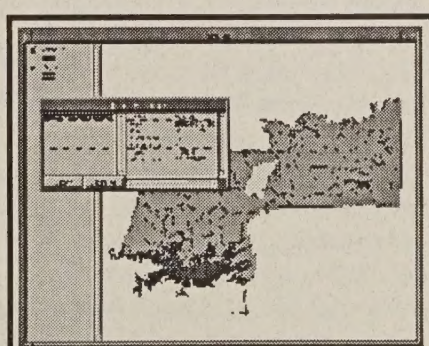
Region-1 Successional Analysis uses a successional analysis methodology to efficiently analyze the roles of pathogens and insects in forest succession. Insects and pathogens recycle far more biomass over the course of stand development than is typically consumed in fires even in fire-intensive ecosystems. The project consists of four phases:

- Examining vegetation changes over a 40-year period
- Discovering relationships between agent actions and vegetation condition and geography
- Associating probable action of pathogens and insects with changes observed in the two datasets resulting from Phase I
- Translating results to predictions of future trends.

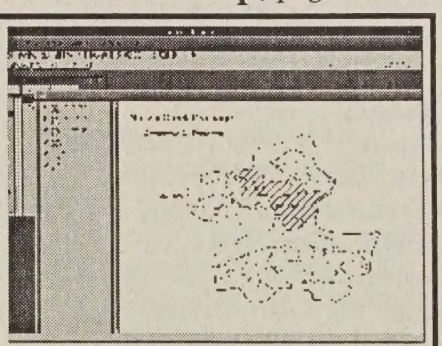
The results from this project are being successfully integrated into forest planning in the Northern Region. The project, which uses the USDA Forest Service Corporate IBM System, was demonstrated by Sue Hagle, of the Northern Region Forest Health staff in Missoula, Montana, with the assistance of Lowell Lewis of the Enterprise Team.

The Enterprise Team's Steve Williams, with partner Eric Twombley of the Pine Ranger District on the Wallowa-Whitman National Forest, demonstrated the **INtegrated FOrest Resource Management System (INFORMS) Version 1.0**, released in February 1997. INFORMS is a decision support system designed specifically for the Forest Service IBM Corporate System (Project 615) platform. INFORMS is the result of development over several years by Williams, Twombley, and partners Forrest Oliveria of the Forest Health staff in Pineville, Louisiana; Doug Loh and staff at the STARR Lab of Texas A&M University; Ron Perisho of the Jessieville Ranger District on the Ouachita National Forest, Bobbie Stiles of the Neches Ranger District on the National Forests in Texas, and many others. The Enterprise Team and the Southern Region Forest Health staff are primary sponsors. INFORMS is currently installed on 12 sites, in all

See Workshop, page 14



INFORMS screen: Color-coded map depicting a project alternative



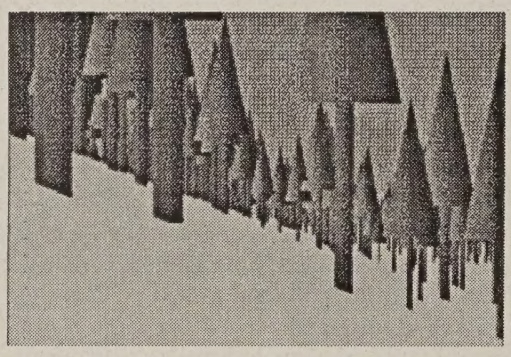
INFORMS screen: Identifying a project boundary

Workshop, from page 13

but one Forest Service Region. The goal is to expand to as many as 100 sites in fiscal year 1998.

Alan Ager of the USDA Forest Service, Umatilla National Forest in Pendleton, Oregon, demonstrated **UPEST**, an insect and disease risk calculator for the Blue Mountains of Eastern Oregon. The program, operational for about three years, has been used in watershed analyses and other planning efforts on the Umatilla and Wallowa-Whitman National Forests. The software, which comes in both DOS and Windows 95 versions, uses two Paradox™ databases, one spatial, one stand-level, for input built from GIS data using UTOOLS software (Ager and McGaughey, 1995). The spatial database contains a variety of topographic and other data such as slope, aspect, azimuth, slope position, harvest history, and plant association. The stand database contains stand composition data describing species, canopy closure, basal area, diameter at breast height, and other stand attributes.

SmartForest-II, a spatially defensible, object-oriented, forest visualizer, was demonstrated by developer Brian Orland, Director of the Imaging Systems Lab, University of Illinois at Champaign Urbana. This three dimensional forest visualization interface uses three information inputs: an elevation map file, a stand file, and a tree list file to draw simulations allowing the user to view a forest from above or ground level and to "walk" among three-dimensional tree icons where each tree represents biological data about tree type, size, and vigor. SmartForest II provides navigational data and analytical tools that enable quick and efficient analyses of entire forest stands. Forest managers can use it to view landscape changes that might occur, such as the effects of insect infestation, fire, or harvesting; to preserve wildlife areas, such as saving individual trees or nesting sites; to monitor biodiversity and changes that may occur due to management decisions; and to see the aesthetic changes that may result from pest control or other management practices.



SmartForest II screen showing simple tree images drawn according to species, diameter, and height, color-coded for elevation, stand, and tree list information

Same SmartForest II image with texture option (more realistic, texture-mapped trees)

Ecosystem Management Decision Support (EMDS), a knowledge-based decision support system for ecological landscape analysis, was demonstrated by Keith Reynolds, of the Corvallis Forestry Sciences Lab, Pacific Northwest Research Station in Corvallis, Oregon. EMDS is a framework for support of ecological landscape analysis at any landscape scale. The system integrates GIS and knowledge-base system technologies to provide a powerful but easy-to-use analytical tool for environmental assessment. EMDS uses the NetWeaver™ knowledge base engine to provide partial evaluations of ecosystem states and processes based on available information; it also provides useful information about the influence of missing data, making it ideal for use in environmental assessments in which it may be necessary to reason with incomplete information.

Sbexpert, a knowledge-based decision support system for spruce beetle management in Alaska, was also demonstrated by Reynolds. Sbexpert 2.0 consists of four separate programs: Sbexpert, an advisory system that provides recommendations for reducing spruce beetle hazard and risk to spruce stands in south central and interior Alaska; Sbtext, providing background information on the biology, ecology, and management of spruce beetles; Sblit, providing database utilities for retrieving literature citations; and Sbhelp, an on-line help program. The system features an intuitive graphical interface, efficient presentation and retrieval of information through hypertext and hypergraphics, easy access to an extensive help system, a library of realistic stand images

See **Workshop**, page 15

Recent Publications

Winter 1998

To order copies of Enterprise Team publications listed here, please check the requested publication in the box at the left of its listing and send this page to: Shirley Wilsey, USDA Forest Service, Enterprise Team, 3825 E. Mulberry St., Fort Collins, CO 80524. Be sure to include your address. Or, phone: 970-498-1732; Fax: 970-498-1660; DG Mailbox: S.Wilsey:W04A; Internet: swilsey/wo,ftcol@fs.fed.us (Forest Service) or swilsey/wo_ftcol@fs.fed.us (outside Forest Service)

Enterprise Team

☐ **FHTET 97-34** Wagner, David L.; Giles, Valerie; Reardon, Richard C.; McManus, Michael L. 1997. Caterpillars of eastern forests. Morgantown, WV: USDA Forest Service, State & Private Forestry, Forest Health Protection, Forest Health Technology Enterprise Team. 113 p.

A reprint of this 1997 publication is now available through the Enterprise Team-Morgantown. Contact Lisa Cress at 304-285-1563, Fax 304-285-1505. This publication includes over 130 species; it will enable forest managers, extension entomologists, and nonspecialists to identify many of the eastern region's most frequently encountered species. Great color!

☐ **FHTET 96-15** Skillen, Elizabeth; Berisford, Wayne; Camann, Michael; Reardon, Richard. 1997. Semiochemicals of forest and shade tree insects in North America and management applications. FHTET 96-15. Morgantown, WV: USDA Forest Service, State & Private Forestry, Forest Health Protection, Forest Health Technology Enterprise Team. 182 p.

Identifies semiochemicals for approximately 100 forest and shade tree insects in North America and describes their operational and potential uses for insect management. Gives the chemical identities of these compounds, pilot tests and uses, and the status for uses that require U.S. Environmental Protection Agency registration.

Other

☐ Thistle, Harold; Skyler, Pat. 1997. Seventh report: National spray model and application technology steering committee--USDA working group. 3400 FHP. 9734-2843-MTDC. Missoula, MT: USDA Forest Service Technology and Development Program. 44 p.

Available from Missoula Technology and Development Center, Fort Missoula, Building No. 1, Missoula, MT 59801.

Mailing Address:

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Workshop, from page 14

indexed to hazard analysis results for visualizing stand damage, automatic report generation, and an integrated text editor that facilitates preparing standard reports.

Shirley Wilsey

ENTERPRISE TEAM UPDATE

Theatrical, from page 7

at the Bark Beetle Working Group Meeting in Brian Head, Utah, in September 1997.

Encores expected

The Canopy Crane is an exciting place to work, and the research possibilities associated with it are only beginning to be realized. The pheromone dispersion study supported by Enterprise Team/Missoula Technology Development Center was just one use of this valuable resource. Thanks to the staff at the Canopy Crane site for all their help in making this a successful project.

For more information on the project, contact Harold Thistle, Missoula Technology and Development Center, Building No. 1, Fort Missoula, Missoula, MT 59801; Phone: 406-329-3900; Fax: 406 329-3719; Internet: thistle@montana.com

Harold Thistle

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Events of Interest

February 23-27. Salt Lake City, Utah. Integrating Remote Sensing into Operational Pest Detection and Monitoring Programs
Contact: Gail Shaw, USDA Forest Service, Remote Sensing Applications Center, 2222 West 2300 South, Salt Lake City, Utah 84119-2020; e-mail: gshaw/wo_rsac@fs.fed.us; Forest Service DG system: g.shaw:W03A; Phone: 801-975-3660; Fax: 801-975-3478.

April 6-9. Nassau Bay, Texas. USDA Forest Service Seventh Biennial Remote Sensing Applications Conference: Natural Resource Management Using Remote Sensing and GIS
Contact: Gail Shaw, Attendance Chairperson; USDA Forest Service, Remote Sensing Applications Center, 2222 West 2300 South, Salt Lake City, Utah 84119-2020; e-mail: gshaw/wo_rsac@fs.fed.us; Forest Service DG system: g.shaw:W03A; Phone: 801-975-3660; Fax: 801-975-3478.

ENTERPRISE TEAM UPDATE